

# Multifunctional, Nanostructured Metal Rubber Protective Films for Space Exploration, Phase I

Completed Technology Project (2006 - 2006)



## Project Introduction

NanoSonic has developed revolutionary nanostructured, yet macroscale, multifunctional Metal Rubber

TM

films. In support of NASA's Vision for Space Exploration, low cost Metal Rubber

TM

freestanding or conformal skins would be optimized as protective coatings for human and robotic space exploration. Specifically, ultra-lightweight, nanostructured coatings with protection against electrostatic charging, abrasion and radiation over a wide range of mechanical and thermal fluctuations are offered. Metal Rubber

TM

is fabricated via layer-by-layer, molecular self-assembly, which enables thickness and placement control over multiple constituents for true nanostructured multifunctionality (nm scale); while advanced polymers have allowed scale-up to free-standing thick films (several mm thick, at < 1 g/cc). Metal Rubber

TM

is not a conducting polymer or a sputter-coated polymer film. It is a freestanding nanocomposite formed in situ by chemically bonding each monolayer of nanostructured constituent, thereby eliminating residual stress between each component. New, ultra-low modulus Metal Rubber

TM

can be strained to > 1000% elongation while remaining electrically conductive; and returns to its original shape and nominal conductivity when released. Bulk resistivity (as low as  $10^{-5} \Omega \cdot \text{cm}$ ), and mechanical moduli (0.1 MPa to 500 MPa) have been demonstrated. Metal Rubber

TM

requires less than 1 vol% of metal, allowing the manufacturing a cost effective, advanced material



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## Table of Contents

Project Introduction	1
Organizational Responsibility	1
Primary U.S. Work Locations and Key Partners	2
Project Management	2
Technology Areas	2

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Johnson Space Center (JSC)

### Responsible Program:

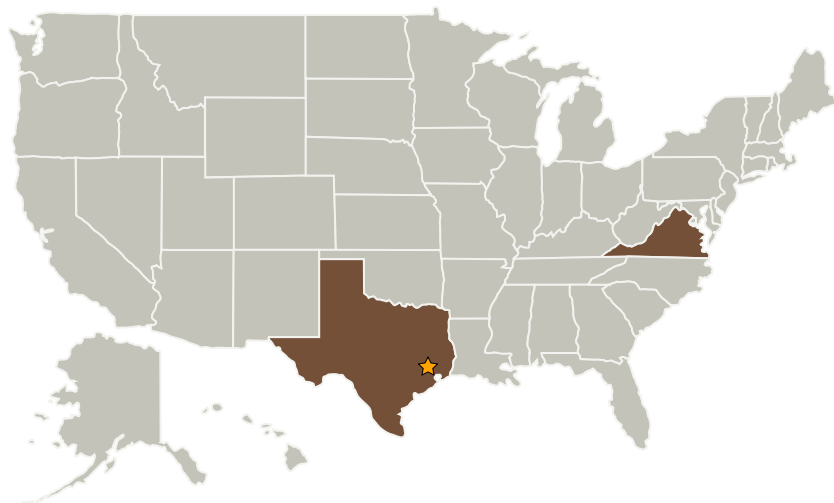
Small Business Innovation Research/Small Business Tech Transfer

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Nanosonic, Inc.	Supporting Organization	Industry	Pembroke, Virginia

## Primary U.S. Work Locations

Texas	Virginia
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## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - └ TX12.4 Manufacturing
    - └ TX12.4.1 Manufacturing Processes